

CATALYTICALLY ENABLED LOW-TEMPERATURE BLEACHING OF COTTON

LIZ MANNING

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IT'S TIME TO SLOW DOWN FAST FASHION



30% of UK clothing has not been worn in over 12 months.*



The World Bank estimates that 20% of global water pollution is caused by the textile industry. Making it the 2nd most polluting industry on the planet, behind oil.



15 million MT of textile waste is generated by the US every year. That's equivalent to 600 Statues of Liberty.



Increasing the lifespan of a garment by 1/3 will decrease its carbon, water and waste footprint by as much as 20%.*



It takes 2650 L of water to produce 1 t-shirt, that's equivalent to 17 bath tubs. More than 8,000 chemicals are currently used in textile production, including heavy metals, solvents and detergents.**

*WRAP, 2016 ** C&EN, 2016

INTRODUCTION

The textile industry is the second most polluting industry on the planet, second only to energy production, and generating 20% of global water pollution (World Bank, 2014). The industry is under pressure to clean up its act but it is a globally diverse, fragmented market with multiple stakeholders.

The consumer's attachment to cheap, fast fashion, and shareholders demanding ever increasing profits drives movement to cheaper, inevitably less-regulated, production centres. There are multiple regulatory bodies, ecological labels, individual brand standards and consumer demands for suppliers to meet.

Textile and apparel suppliers vary greatly in size, technical capability, and financial security. Game-changing technologies, that can enable greener production can struggle to reach large proportions of the market. Any innovation must be economically, as well as, environmentally sustainable. Ideally, the technology will incorporate directly into current production practices, requiring minimal re-training.

Catexel introduced such a technology to the market in 2010, based on a transition metal based catalyst, originally designed for laundry detergent.

THE TECHNOLOGY

At Catexel we brought our Pegasus catalyst for low-temperature bleaching of cotton to market in 2010. The catalyst is highly effective and is now used by cotton manufacturers on three continents.

Traditionally, cotton is bleached at high temperatures (95-110 °C), at high pH, and using surfactants and hydrogen peroxide. The goal, chemically, is to degrade the colour-causing chromophores found naturally within the cotton, such as morin (see Figure 1). This process will take approximately one hour and the harsh conditions cause some loss in degree of polymerisation of the cotton, reducing yields.

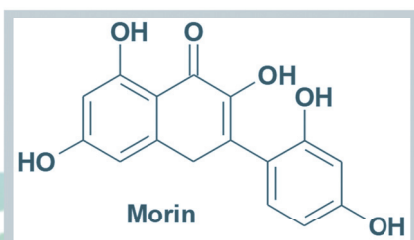


FIGURE 1: CHEMICAL STRUCTURE OF MORIN

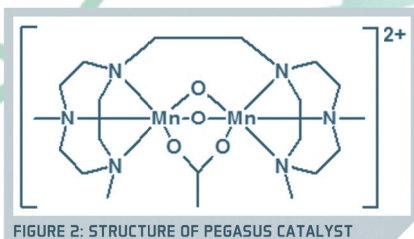


FIGURE 2: STRUCTURE OF PEGASUS CATALYST

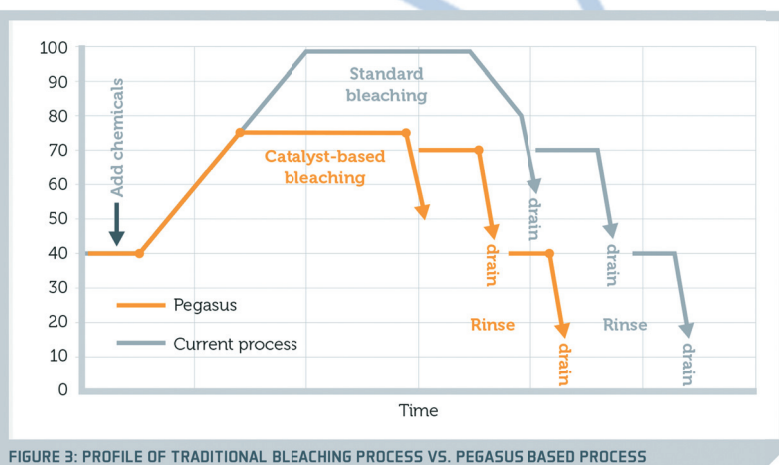


FIGURE 3: PROFILE OF TRADITIONAL BLEACHING PROCESS VS. PEGASUS BASED PROCESS

Pegasus is a manganese based catalyst (see Figure 2), originally designed for laundry detergent. The catalyst activates hydrogen peroxide under alkaline conditions, enhancing its activity. This activation enables cotton to be bleached at lower temperatures and in reduced time. Only very small amounts of Pegasus (micromolar levels) are required to achieve the desired results meaning, with the reduced energy and time, that cost neutrality or even cost savings can be achieved. Crucially, the catalyst causes no damage to the cellulose fibres, in fact the milder conditions reduce damage, increasing yields.

THE RESULTS

With the introduction of Pegasus, bleaching temperatures can be reduced to 70 °C and the time to 30 minutes (see Figure 3). Furthermore, the milder conditions have a number of added, secondary benefits such as softer fabric and less creasing.

KEY BENEFITS

- ◆ Up to 15% cost reduction vs. traditional processing
- ◆ Improved yields, by up to 2%
- ◆ Softer fabric feel
- ◆ Less creasing and pilling in finished cotton

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CATALYSTS FOR CHANGE

WHO ARE CATEXEL?

Catexel is an expert oxidation catalysis company that has developed unique technology platforms based on iron and manganese compounds for use in global manufacturing. We have a library of more than 3000 catalysts, originally developed for laundry detergent, but applicable across a wide range of different industries and applications.

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